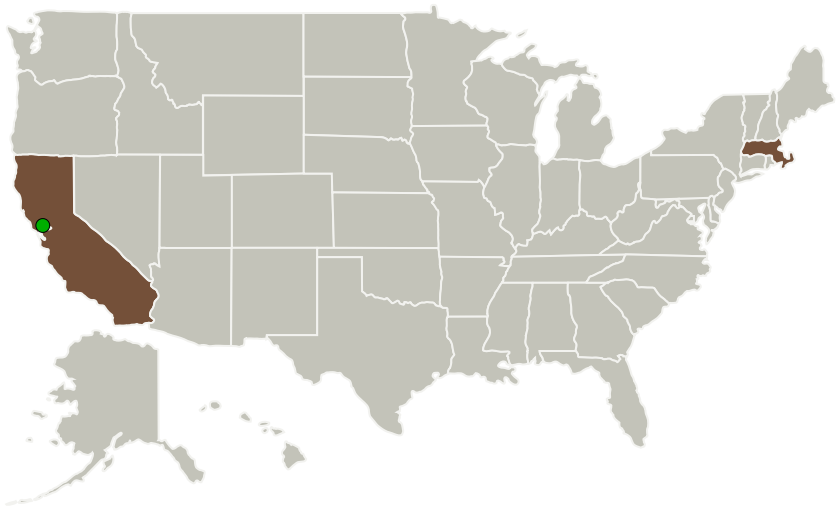
NDE for Ablative Thermal Protection Systems, Phase II

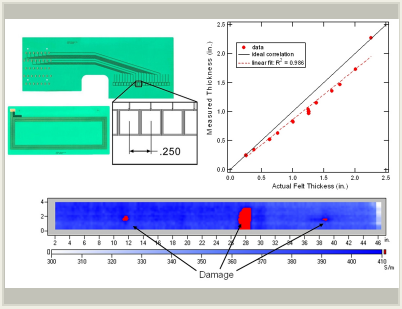
Completed Technology Project (2014 - 2016)

Project Introduction

This program addresses the need for non-destructive evaluation (NDE) methods for quality assessment and defect evaluation of thermal protection systems (TPS). Novel linear drive eddy current methods are proposed for NDE of carbon-based TPS materials, such as felts, rigid materials, and three dimensional woven fiber composites. Using a combination of physics-based models of layered media, including an eddy current micromechanical model extension for composites, multivariate inverse methods, high resolution imaging, and innovative sensor array constructs, the developed methods will independently measure the material characteristics of interest. In Phase I, the focus was on adapting methods developed for carbon-based composite structures and laminates and demonstrating feasibility of these methods for felts, rigid materials, and three-dimensional woven composites. In Phase II, the focus is on maturing this method, including the instrumentation hardware, models, and sensor designs, to provide scanning assessment and in-situ monitoring capabilities for TPS material condition assessment. JENTEK's MWM-Arrays have a linear drive that permits both scanned type imaging and permanent installation for monitoring of anisotropic properties, temperature, and stresses at multiple depths. The projected depth of the magnetic field into the test material can be adjusted through the sensor dimensions and excitation frequencies; this enables inspection of materials more than 1.0-in. thick and supports measuring far-side surface recession in ablator materials. JENTEK delivered the MWM-Array solution used by NASA KSC on the Space Shuttle Leading Edge to detect damage of the Reinforced Carbon-Carbon (RCC) thermal protection tiles; thus JENTEK is well-positioned to deliver a practical TPS NDE solution.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
JENTEK Sensors, Inc.	Lead Organization	Industry	Waltham, Massachusetts
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations	
California	Massachusetts

Project Transitions

April 2014: Project Start

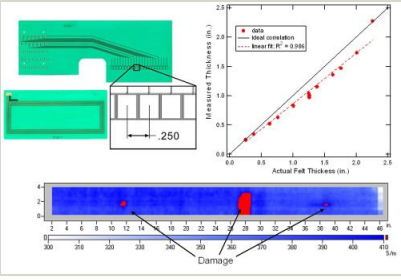
April 2016: Closed out

Closeout Summary: NDE for Ablative Thermal Protection Systems, Phase II Project Image

Closeout Documentation:

- Final Summary Chart Image*(https://techport.nasa.gov/file/137612)*

Images



Briefing Chart Image
NDE for Ablative Thermal Protection Systems, Phase II
(https://techport.nasa.gov/image/134064)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
JENTEK Sensors, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

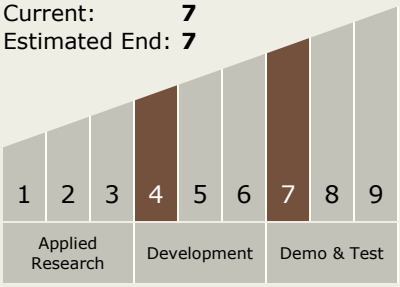
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Andrew Washabaugh

Technology Maturity (TRL)

Start: **4**
Current: **7**
Estimated End: **7**



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Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.3 Thermal Protection Components and Systems
    - TX14.3.4 Thermal Protection System Testing

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System